

WHAT IS CLAIMED IS:

1. A method for regulating a gene in a microorganism, comprising:

contacting a microorganism, in which the gene is to be regulated, with 4,5-dihydroxy-2-cyclopenten-1-one (DHCP); and

regulating the gene in the microorganism, wherein the gene is selected from the group consisting of genes encoding ribosomal proteins, genes responding to stress, genes involved in membrane synthesis and membrane function, genes involved in general metabolism, genes encoding proteins with diverse functions, and genes encoding proteins of unknown function.

2. The method according to claim 1, wherein the gene is selected from the group consisting of those listed in Tables 1-7 and homologues thereof.

3. The method according to claim 1, wherein the gene is involved in quorum-sensing processes.

4. The method according to claim 3, wherein the gene is regulated as a result of inhibition of an activity of an interspecies autoinducer AI-2.

5. The method according to claim 3, wherein the gene is regulated as a result of switching on/off of a quorum-sensing circuit.

6. A composition for regulating a gene in a microorganism by the method defined by claim 1, which contains DHCP as an active ingredient.

7. Use of DHCP for the manufacture of a composition for regulating a gene in a microorganism by the method defined by claim 1.

8. A method for screening a physiologically active substance, comprising:

(a) incubating a microorganism in the presence and in the absence of a candidate substance;

(b) determining the expression levels of genes in the microorganism in the presence and in the absence of the

candidate substance, wherein the genes are ones in which their expression levels are influenced by DHCP;

(c) identifying the candidate substance as a physiologically active substance which significantly influences the expression level of at least one of the genes if the expression levels in the presence of the candidate substance is significantly enhanced or reduced relative to expression levels in the absence of the candidate substance.

9. The method according to claim 8, wherein the genes are selected from the group consisting of those listed in Tables 1-7 and homologues thereof.

10. The method according to claim 8, wherein the expression levels of the genes are determined based on the amounts of mRNA transcribed from the genes.

11. The method according to claim 10, wherein the expression levels of the genes are determined by hybridization using a DNA microarray.

12. A physiologically active substance which is obtainable by the method of claim 8.

13. A method for enhancing the production of a recombinant polypeptide in a microorganism, comprising:

(i) culturing a microorganism in the presence of DHCP to enhance the expression and production of a recombinant polypeptide; and

(ii) recovering the recombinant polypeptide produced from the culture.

14. A method for inhibiting an activity of an interspecies quorum-sensing inducer, wherein DHCP is used as an active ingredient.

15. The method according to claim 14, wherein the inducer is AI-2.

16. A composition for regulating quorum-sensing, which contains DHCP.

17. The composition according to claim 16, which

regulates expression of *cysK*.

18. A composition for switching on/off of a quorum-sensing circuit, which contains DHCP.

19. A composition for inhibiting an activity of an interspecies quorum-sensing inducer, which contains DHCP.

20. The composition according to claim 19, wherein the inducer is an autoinducer AI-2.

21. A composition for regulating expression of a gene responding to stress, which contains DHCP.

22. A composition for regulating expression of a regulatory gene for quorum-sensing, which contains DHCP.

23. A composition for regulating expression of a gene selected from the group consisting of the genes listed in Tables 1 to 7, which contains DHCP.

24. A composition for promoting secretion of a recombinant protein, which contains DHCP.

25. A composition for maintaining homeostasis, which contains DHCP.